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DIVERTER VALVE/FILTER AND DOWNPIPE FILTER

FIELD OF THE INVENTION

The following invention relates to a diverter valve and filter arrangement, typically adapted to receive water from a downpipe from the eaves of a building. The invention also relates to a downpipe filter.

BACKGROUND ART

It is known to collect rainwater from roof gutters and store the same in storage tanks. When the stored water is intended for human consumption, it ought to be substantially devoid of pollutants and sediment.

It is known to provide the inlet to water storage tanks with a filter to prevent the ingress of sediment and leaves for example. Such filters or strainers are effective, but not highly efficient in removing water borne debris.

It might also be desirable to provide a filtration means for connection in line with a downpipe to filter water prior to its entry to underground pipes so as to prevent the blockage of those pipes.

It is known to provide a method of flushing debris and airborne impurities such as acid rain that amalgamates in the precipitation process by flushing a desired quantity of water to a waste water pipe prior to diverting rainwater to a clean water tank, after the desired flushing has been completed.

OBJECT OF THE INVENTION

It is the object of the present invention to overcome or substantially ameliorate the above disadvantages and/or more generally to provide an improved diverter valve and filtration unit and also to provide an improved down pipe filter.

DISCLOSURE OF THE INVENTION

In one form of the invention there is provided

a downpipe filter including an inlet to receive water from a roof gutter,

a first branch from the downpipe for directing diverted water from the downpipe to a filter,

a return branch from the filter for returning filtered water to the downpipe, and

another filter to filter water from the downpipe and situated between the first branch and the return branch.

Preferably the filters are stainless steel gauze filters.

Preferably there is associated with the first branch a dirt trap to trap dirt which is filtered by the filters.

Preferably the dirt trap has a removable bung to enable cleaning of dirt from the dirt trap.

Preferably there is provided upstream of the first branch a safety plug which is designed to open and allow release of water from the downpipe if the filters become blocked to a degree sufficient to cause a backup of water in the downpipe.

Preferably downstream of the return branch there is provided a secondary filtration unit including a second branch from the downpipe which delivers water to a fine filter, water having passed through the fine filter then being returned via a second return branch to the downpipe.

Preferably there is provided a further filter in the downpipe in between the second branch and the second return branch.

Preferably the fine filter is a fine sock filter.

Preferably there is provided a removable bung above the fine sock filter.

Preferably both removable bungs are threadably engaged with the filtration unit.

In another form of the invention there is provided:

a diverter valve/filter unit, including:

a branch extending from a downpipe for passing water diverted from the downpipe and returning the water to the downpipe via a water tube and return branch,

a shut-off valve for closing the downpipe downstream of the return branch,

a filtration device associated with the water tube,

a water flow rate detection device calibrated to measure the flow rate of water through the downpipe and to close the shut-off valve upon detecting a predetermined flow rate of water through the downpipe, whereupon water backs up in the water tube for bypassing via the filtration device to a storage tank, and wherein said shut-off valve is opened by the flow rate detection means upon detecting a diminished flow rate of water to the downpipe to enable water from the return branch to be delivered to the downpipe at a downstream position.

Preferably the filtration device includes a secondary filter downstream of a primary filter.

Preferably the primary filtration device includes a dirt trap associated with the branch which extends from the downpipe, there being further provided one or more filter screens between the branch and the water pipe.

Preferably both the primary and secondary filters have associated therewith removable bungs to enable cleaning of the filters.

Preferably the water flow rate detection device includes a cylinder mounted within the downpipe downstream of the branch therefrom, the cylinder being movable up and down along the downpipe and being biassed upwardly by biassing means, the cylinder having a hollow interior to receive water from the downpipe and including a drain to slowly release water therefrom, the cylinder gaining weight as it fills with water so as to counteract the bias of the biassing means so as to move the shut-off valve.

Preferably the drain is a hollow shaft extending downwardly from the cylinder and the shut-off valve is mounted to the shaft.

Preferably a shut-off valve closes against a valve seat situated within the downpipe.

Preferably the rate of water flow delivered to the cylinder is adjustable by means of a valve tap situated upstream thereof.

Preferably an extendible bellows extends from the valve tap to the upper end of the cylinder.

Preferably the biassing means is a coil spring through which the shaft extends.

Preferably associated with the drain is a valve tap which enables adjustment of the emptying rate of the cylinder.

Preferably the drain drains to a downstream position of the downpipe.

Preferably a plug is situated downstream of the valve tap.

According to a further aspect of the invention there is provided a diverter valve and filter unit for connection to the downpipe of a guttering system including a tank having a tank inlet and two tank outlets, a first tank outlet for passing water after passage through a filtration means, a second tank outlet for passing water without filtration, a first valve means for controlling opening and closing of said second tank outlet depending on the flow rate of water through said tank inlet, said first valve means including a reservoir having an outlet to the reservoir through which said reservoir empties, an inlet to the reservoir for filling said reservoir from said tank inlet, means biassing said first valve means open, said reservoir inlet including second valve means for regulating the filling of said reservoir depending on said flow rate through said tank inlet, said valve means closing said unfiltered output after a predetermined time. The predetermined time is set by the said flow rate and the

differential rate of filling and emptying of said reservoir. Preferably, the reservoir is an enclosed structure within the tank.

Preferably, the tank inlet is connected to the downpipe of a guttering system of a building. It may be inserted in the downpipe section to clean up the water flow before entry to the stormwater system or before storage for consumption.

In this aspect of the invention, the diverter valve allows the initial flow of water in a rain shower to bypass the filter section of the unit. This early flow usually carries dirt and debris from the collecting surfaces and this unit allows the contaminated water to be directed to a secondary storage where it may be further processed or, if desired, discarded. This reduces blockage of the filter of the unit and flushes the unit. Once the first valve shuts, the water exits via the filtered output.

When the flow is above a given rate the reservoir fills at a greater rate than it empties through said reservoir outlet whereby the weight of the reservoir overcomes the bias of the biassing means to shut the unfiltered tank outlet. Two forms for operating the first valve are disclosed. In one form, the biassing means is a spring supporting said reservoir above said unfiltered outlet, said reservoir outlet is a hollow tube aligned with said unfiltered outlet, and said tube has a plate affixed thereto at a given distance above said unfiltered outlet such that when said plate moves said given distance said plate covers and closes said unfiltered outlet. Preferably, said unfiltered outlet or said plate has a sealing means which is engaged when the plate closes said outlet opening to substantially prevent water flow therethrough.

In an alternative arrangement for operating the first valve, the biassing means is a spring supporting said reservoir above said unfiltered outlet, said reservoir outlet is an aperture in said reservoir and said first valve includes a shaft attached to said reservoir and aligned with said unfiltered outlet with said shaft having a plate affixed thereto at a given distance above said unfiltered outlet such that when said reservoir moves said given distance said plate covers and closes said unfiltered outlet, said unit further including a third valve means in a lower portion of the tank for regulating the loss of

water therefrom. Preferably, the third valve means is a drip valve. Preferably, said unfiltered outlet or said plate has a sealing means which is engaged when the plate closes said outlet opening to substantially prevent water flow therethrough.

The unfiltered output may be directed to a separate storage for use as irrigation while the filtered output may be directed to a water storage for consumption, or, as stated above, as a cleaned source to a stormwater system. Other uses are contemplated within the knowledge of a person skilled in the art.

Preferably, the inlet to the reservoir includes a tube having a flow control valve.

Preferably the tank inlet feeds water to a valley within said tank, said valley having an opening therealong communicating with said tube and terminating at a lip from which water falls into said tank. Said tube may also have a branch tube connecting thereto below said flow control valve and bleeding water from a given level within said tank.

Preferably, the tank has an opening or openings for allowing drainage and cleaning thereof including removal or in situ cleaning of the filtration means. The filtration means may be stainless steel gauze filters or other filtration material as well known to a person skilled in the art.

Preferably, the first valve resets after a given time to open the unfiltered outlet. In this way flushing of dirt and debris from the interior of the tank is performed automatically. In addition, preferably, the lip of the valley is directed onto the rear of the filtration means to wash debris therefrom.

In both the downpipe filter and diverter valve/filter unit as disclosed above, a safety plug can be provided upstream to enable a burst and exit of water should the units become clogged with debris downstream thereof.

BRIEF DESCRIPTION OF THE DRAWING

Preferred forms of the present invention will now be described by way of example with reference to the accompanying drawings wherein:

Figure 1 is a schematic elevational view of a downpipe filter unit;

Figure 2 is a schematic elevational view of a diverter valve/filter unit;

Figure 3 is a schematic elevational view of a further diverter/filter unit;

Figure 4 is a schematic elevational view of a first drain and reset system for use in the diverter/filter unit of Figure 3; and

Figure 5 is a schematic view of a second drain and reset system for use in the diverter/filter unit of Figure 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In Figure 1 of the accompanying drawings there is schematically depicted a downpipe filter unit 10. Unit 10 is to be fitted in line with a downpipe 19 which would ordinarily take the water from a roof gutter to an underground stormwater pipe. A first branch 18 extends from the downpipe 19 at a position just upstream of a stainless steel gauze filter 12. Water-borne debris within the first branch 18 is delivered to a dirt trap 14 just downstream of another stainless steel gauze filter 13 through which water is returned via a return branch 22 to the downpipe 19. Further downstream of the downpipe there is provided a second branch 20 just upstream of a stop end 23. The pre-filtered water passing through the second branch 20 is delivered to a fine filter sock 17 from which the filtered water is returned via a return branch 21 to the downpipe 19.

Water tube 50 is connected to branch 59 through which water is directed to the downpipe 31 which in turn is allowed to pass through outlet 40 via a valve system to be described below.

Beneath the dirt trap 14 there is provided a removable bung 15, the removal of which enables cleaning of the dirt trap 14.

Similarly, associated with the fine filter sock 17 is another removable bung 16 to enable removal and cleaning of the fine filter sock.

In the event that both of the stainless steel gauze filters 12 and 13 become blocked, and/or in the event that the fine filter sock 17 becomes blocked, the system is provided with a safety plug 11 which will burst should water bank up thereto.

The above described filter unit is intended to filter storm water from eave guttering prior to delivering it to the storm water system.

In Figure 2 of the accompanying drawings there is schematically depicted a diverter valve/filter unit 30, the intended function of which is twofold. Firstly, the system is intended to deliver clean filtered water via an outlet 46 to a storage tank during times of heavy rain when relatively clean water is flowing to the downpipe, most gutter debris having already been flushed to storm water. Secondly, the system is designed to filter the water from the roof gutter prior to delivery of the water to the stormwater system.

The unit 30 includes a first branch 56 extending from a position just upstream of a gauze filter 32 within the downpipe 31. Within the first branch 56 there is provided a stainless steel gauze filter 54 at the upper end of a vertical water tube 50. Water which does not pass through the filter 54 is delivered to a dirt trap 52 situated just downstream of another gauze filter 53 through which water is filtered and delivered via a cross-branch 57 to the water tube 50. Associated with the dirt trap 52 is a threaded removable bung 51 to enable cleaning of the dirt trap 52. Downstream along the water tube 50 there extends a second branch 58 having a gauze filter 48 therein. Water passing through the gauze filter 48 is presented to a fine filter sock 47 from which filtered water is delivered via outlet 46 to a storage tank. The bottom end of the water tube 50 is connected to a return branch 59 through which water is returned to the downpipe via a valve system to be described below.

Between the downstream part of the sock filter 47 and the water tube 50 there is provided a stop end 45 having a small hole 60 therethrough.

The valve system includes a cylinder 35 adapted to move up and down within the downpipe 31. The cylinder 35 is adapted to be filled with water which passes through the gauze filter 32. A valve tap 33 is provided downstream of the filter 32 to control the flow of water to the cylinder. Between the valve tap 33 and the top of the cylinder 35, there is provided a rubber boot 34 which can extend and contract. Water passes through the rubber boot to the interior of the cylinder 35. Cylinder 35 might be formed of rigid plastics material or metal for example.

The bottom of the cylinder 35 is supported by a compression spring 36, the bottom end of which bears upon a seal 37 fixed to the interior of the downpipe 31. A hollow tube or rod 44 passes through the coil spring 36 and the seal 37 and serves as a drain for water in the cylinder 35. A valve tap 42 is provided at the bottom end of the rod 44 to enable adjustment of the rate at which water drains from the cylinder.

A valve, stopper or plug 38 is fixed to the rod 44 and is adapted to bear against a valve seat 39 within the downpipe. When the cylinder 35 fills with water during times of heavy rain, the weight of the cylinder bears against the spring 36 and presses the valve 38 against the valve seat 39 so as to stop the flow of water from branch 59 to the stormwater system via waste outlet 40. Water still passes to waste outlet 40, being that which passes through the rod 44 and tap 42. When the valve 38 closes, water within the water tube 50 banks up so as to promote the flow of water via the second branch 58 to the fine filter sock 47 and then via outlet 46 to the storage tank. So long as the rain continues to fall heavily, the valve 38 will remain closed. When the rain dies down, the cylinder 35 will drain through tap 42, causing valve 38 to open as a result of spring force allowing the water from water tube 50 to pass to the stormwater system via outlet 40. A small hole 60 in the stop end 45 prevents water being trapped in the tank delivery pipe 46. Such trapped water might otherwise become stagnant.

A removable plug 43 enables access to the tap 42 for adjustment and maintenance.

Further forms of a filter and diverter unit are shown in and will now be described with respect to Figures 3, 4 and 5. A tank 100 has a water inlet 102, for example connected

to the downpipe of a guttering. A water outlet 104 is provided in the bottom of the tank controlled via the shut-off valve 106.

The tank 100 has a clean water outlet 112 covered by a filter screen 114 of a type as described above. Debris entering the tank 100 through the water inlet 102 is deposited in the tank 100 or exits through outlet 104.

Clean water is taken from the water outlet 112 after filtering by the filter 114 with the initial flow of rainfall being directed through the contaminated water outlet 104 controlled by the shut-off valve 106. The rate of wastage through the outlet 104 is controlled by the relative rates of filling and emptying of the tank 110.

The tank 110 is an enclosed structure housed within the larger tank 100 and acts as a regulator to open or shut the valve 106 depending on the flow rate from the water inlet 102 in a manner which will be described more fully below.

Referring to Figures 3 and 5, one method of operating the shut off valve 106 is shown. The shut-off valve 106 is a plate fixed to a shaft 108 which in turn is connected to the tank 110. The tank 110 is emptied through the drain 109 at a rate determined by the size of the drain 109. The shut-off valve 106 is regulated by water filling the tank 110 through the tube 154 while water is being discharged therefrom at the same time through the drain 109. The water entering through the inlet 102 falls onto a valley 150. The valley 150 has an aperture 152 therein connected to the tank 110 through the water tube 154. The tube 154 is connected to the interior of the tank 110 and sealed thereto with the seal 162. The majority of the water entering the tank 100 flows along the valley 150 and falls into the tank 100 at the lip 155. The valley 150 is directed downwardly within the tank 100 in order not only to help in filling the tank 100 but also to direct a flow of water from the lip 155 to the rear of the filter 114 to flush debris that may gather thereon.

The water tube 154 includes a water control valve 156, for example a tap, which controls the flow of water through the tube 154 and hence into the tank 110. The tube

154 has an additional arm 160 which provides a take off or over flow at a given level of fluid in the tank 100. Once the fluid level reaches the level of the inlet 161 of the tube 160 the water control valve 156 is by passed and the tank 110 is filled more quickly to thereby activate the shut-off valve 106 more promptly.

Referring to Figure 5, a drip valve 120 is located in a removable cap 130 at one end of a tube 129 attached to the side of the tank 100. The cap 130 allows access to tube 129. Turning the adjustment screw 122 within the tube 129 moves the pressure adjustment plate 132 with respect to the plate 133 to alter the pressure being applied to the filter material 140, for example made of a sponge like filter material, which is located between the pressure adjustment plate 132 and a grate 127 to which is also attached a filter 131, for example made of a metal gauze material. This pressure alters the flow rate through the filter 131 into tube 129. The plates 132, 133 have respective water release holes 134,135 to allow flow therethrough of fluid, partially retained by the pressure plate 132, to escape via drip valve 120. This regulates water loss from the tank 100 (and tank 110 equally) to determine the reset time of the shut-off valve 106.

As the tank 110 is filled with water its weight increases until it is sufficient to overcome the bias of the spring 170 and the tank 110 moves downwardly so that the valve 106 closes the opening and by engaging a seal (not shown) seals the outlet 104 shut. The plate comprising valve 106 is aligned with the outlet opening 104 by having the shaft 108 engage in an apertured plate 107 fixed to the opening of the outlet 104. The tank 110 continues to drain through the drain 109 into the tank 100 and the water in tank 100 drains via drip valve 120. Once the weight of tank 110 is insufficient to overcome the bias of the spring 170 the shut-off valve is again opened to allow the dirty water bypass, outlet 104, to operate. This reset time may be of the order of 24-48 hours.

An alternative arrangement for operating the shut-off valve 106 is shown in Figure 4. The tube 154 is connected to the interior of the tank 110 and sealed thereto with the

seal 162 as stated above. A further seal 164 is located on the inside of the tank 110. The tube 154 has a waisted portion 166 made of a resilient material.

The valve 156 and bypass branch 160 control the rate of filling of the tank 110 as described above. The rate of emptying of tank 110 is controlled via the drain 157. The drain 157 is a hollow tube attached to the tank 110 and to which the shut off valve plate 106 is fixed at a distance above the outlet 104 in the manner as described above and at least extends into the outlet 104 when the outlet is shut by the valve plate 106. Once the tank is filled sufficiently for its weight to overcome the bias of the spring 170, the tank 110 moves downwardly so that the valve 106 closes the opening and by engaging a seal (not shown) seals the outlet 104 shut. The plate comprising valve 106 is aligned with the outlet opening 104 by having the drain 157 engage in an apertured plate 107 fixed to the opening of the outlet 104. When the tank 110 moves, the waisted portion 166 of tube 154 is engaged by seal 164 to close off tube 154 in an airtight manner. Water and air continue to leave and enter the tank 110 through the drain 157 as drain 157 connects through valve 106 into the outlet 104.

As air fills the tank 110, the buoyancy of the tank 110 in relation to the volume of water contained within the larger tank 100, assisted by the force of the spring 170, raises the tank 110, and the valve 106 attached thereto, to open the outlet 104.

Modifications and alterations obvious to those skilled in the art are contemplated as within the scope of the present invention. For example, means might be provided for storing relative unfiltered water outlet from point 40 in Figure 2 or outlet 104 in Figure 3 for the purpose of watering dry areas such as trees or shrubs. Or, for example, in place of the arrangement shown in Figure 4, air may be admitted into the tank 110 via an air tube. The tube would extend above the water level in tank 110, when the valve 106 is shut, at one end and outside the tank 100 at the other end. An air filter is connected to the external end of the air tube while a one way air control valve is fixed at the other end of the air tube above the water level to control air flow into the tank 110. Water release from the tank 110 is controlled by water release valves at the external end of drain 157.